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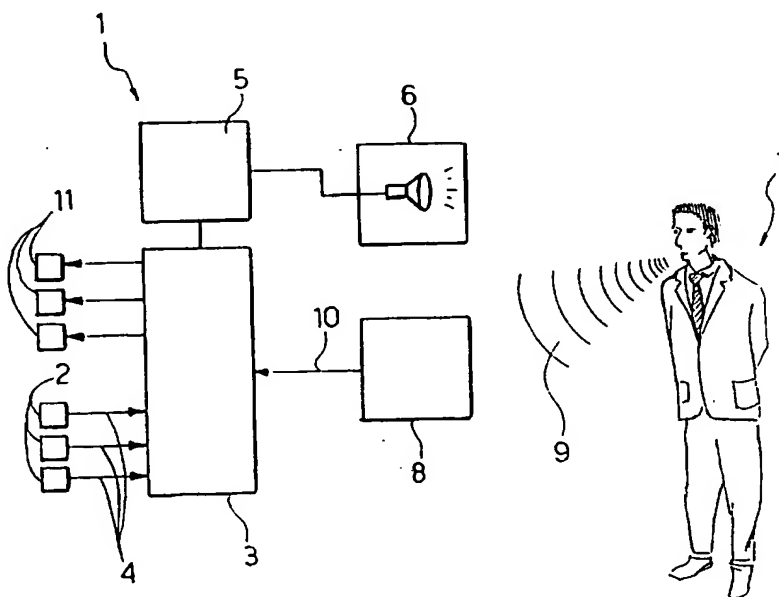
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(54) Title: A VOCAL CONNECTION SYSTEM BETWEEN HUMANS AND ANIMALS



(57) Abstract: A vocal connection system comprises a matrix of sensors (2) adapted to send signal indicative of a status of the animal, in terms of stimuli, feelings, events, actions or behaviours, of the animal, to a microprocessor (3). The microprocessor (3) selects depending upon the signals (4) which are received, a vocal message recorded in memory means (5) associated to the microprocessor (3) and activates a loudspeaker (6) forming part of the system for emitting the vocal message. The system further comprises vocal recognition means (8) which activate stimuli generators (11) as a function of the contents of a vocal message (9) emitted by the human user (7).

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"A vocal connection system between humans and animals"

\* \* \*

5 The present invention is directed to a vocal connection system between humans and animals.

Scientific studies and tests have been carried out in the past with regard to the possibility of establishing a communication between humans and animals. To this end, tests have been carried out by  
10 positioning a number of sensors on the head of the animal which are connected to a computer and detecting the emission of various signals from the animal brain as a function of each different specific thought/wish of the animal (feeling of hunger, thirst, fear, etc.).

15 Systems are also known for communicating with animals which enable sound patterns emitted by the animals to be automatically identified, by attributing the corresponding meaning thereto.

In this regard, for instance, International Patent  
20 Application WO 00/13393 discloses a system of this kind in which an audio interface is provided able to receive sounds emitted by the animals, a memory unit which includes pre-programmed sound patterns and a computer which activates an interface for communication with a  
25 remote unit when the sounds emitted by the animals correspond to determined pre-programmed patterns. Systems of this kind have been used for remote control of cattle and for immediately identifying situations of distress of specific animals so as to enable an  
30 attendant to promptly intervene.

Other similar solutions provide for the use on dogs of collars which include a microphone and an electronic unit provided with a LCD display. The unit is able to display pre-programmed words and sentences,  
35 which should express the feelings or mood of the dog on

the basis of the way of barking, detected by means of the microphone.

Devices are also known which are called "electronic collars" used for training dogs. These collars integrate one or more electrodes which enable a trainer to cause electric shocks of variable intensity to the animal, through a remote control. In this manner, the trainer may immediately correct an error made by the dog during its training, while being distant therefrom.

However, at present there are no devices in the art which can provide a real bi-directional communication between humans and animals.

On the other hand, the possibility of using a reliable and efficient system for vocal communication with animals, in particular with domestic animals, would be enormously appreciated by those who love animals and own one or more of them, apart from opening the way to the possibility of an easier training of the domestic animal, also by non experts.

In view of providing this possibility, the invention is directed to a vocal connection system between humans and animals, in particular domestic animals, characterised in that it comprises:

- a matrix of sensor which is to be positioned on the animal, in particular on its head and/or its neck, for converting information detected on the animal body into electric signals indicative of a status of the animal, in terms of stimuli, feelings, events, actions or behaviours,

- processing means operatively associated to the sensor matrix, including memory means in which human vocal messages are recorded corresponding to different status of the animal,

- a loudspeaker operatively connected to the processing means,

- said processing means being arranged for receiving the signals coming from the sensors and for  
5 activating said loudspeaker in order to emit a vocal message selected in said memory means, as a function of said received signals.

Once the various stimuli emitted by the body of the animal in the various situations are detected, it  
10 is then possible to cause activation of a pre-recorded simplified vocal language (such as "I am hungry", "I am thirsty", etc.) which thus simulates the possibility of speaking for the animal.

In the preferred embodiment of the invention, the  
15 system further comprises means for vocal recognition adapted to provide the processing means with signals representative of the contents of vocal messages emitted by the human, and stimuli generating means operatively associated to the body of the animal, in  
20 particular to the head and/or to its neck, which receive from the processing means said signals representative of the contents of the vocal messages emitted by the user and send corresponding stimuli to the animal brain.

25 Due to the above-mentioned characteristic, as well as to the presence of a controlling logic which is preferably based on the use of neural networks, the system according to the invention can be programmed to provide an interactive self-learning method in which  
30 humans and animals are at the same level.

An embodiment of the invention will be further described in the annexed drawings, given purely by way of non limiting example, in which:

- Figure 1 shows the head of a domestic animal,  
35 specifically a dog, with a collar on which a unit is

positioned which forms part of the system according to the invention, and

- Figure 2 is a block diagram which shows the structure of the unit of figure 1 in a simplified form.

5 With reference to the drawings, numeral 1 generally designates a unit for bi-directional communication between humans and animals, made according to the teachings of the present invention.

Unit 1 includes a number of sensors 2, provided  
10 for detecting and sending signals 4 to a microprocessor 3, these signals being representative of various thoughts/wishes of the animal.

In the preferred embodiment of the invention, the unit 1 is integrated in a collar, designated by C in  
15 figure 1, so that first and second sensors 2 are positioned just below a respective ear of the animal, the remaining sensors being arranged around the neck of the animal.

In this manner, the above-mentioned first and  
20 second sensors 2 are close to the occipital cortex (rear O1 and rear O2: even number on the right side of the skull, and odd number on the left side of the skull) and are particularly adapted for detecting cerebral waves. The remaining sensors 2 are instead  
25 mainly intended for recording signals in an annular area relatively close to the volume where cerebral signals are generated, i.e. the neck of the animal, and where contraction of muscles and nerves are relevant for the purpose which is here of interest.

30 The detections carried out by the sensors 2 are substantially of electroencephalographic (EEG) and electromiographic (EMG) type.

As known, electroencephalography makes use of electrodes arranged on the head of a subject to detect  
35 and measure patterns of electric activity of the brain,

provided by millions of neurons located mainly in the cerebral cortex. On the other hand, electromiography is a similar technique, aimed to the detection of electric activity due to muscular contractions and to the  
5 analysis of the qualitative and quantitative variations of potential of the moving member.

EEG and EMG analysis can provide information useful and objective on specific transient stimuli-events-actions-behaviours of a subject under  
10 examination. In this regard, it is to be noted that sensors 2 are not provided only to detect conventional cerebral waves, in terms of spontaneous electric activity of the cerebral cortex, but also for detecting a general spectrum of signals which are the consequence  
15 of specific transient stimuli-events-actions-feelings-behaviours, including those caused by the movement of the muscles.

Reverting to figure 2, reference numeral 5 designates memory means in which a first database is  
20 recorded in which a plurality of different human vocal messages are codified, corresponding to different signals 4 which the microprocessor 3 receives, representing stimuli-events-actions-feelings-behaviours of the animals.

25 To this end, the microprocessor 3 is programmed for selecting in the memory means 5 the message corresponding to the signal 4 which is received and for activating a loudspeaker 6, in order to send at the output, towards a person 7, a vocal message  
30 corresponding to the thought/wish of the animal.

The unit 1 further comprises vocal recognition means 8, which receive a vocal message 9 emitted by a person 7 and send signals 10 at the output which are received by the microprocessor 3.

As a function of the type of signal 10 which is received, the microprocessor 3 activates a plurality of stimuli generators 11, which send stimuli to the brain of the animal corresponding to the vocal message emitted by the user 7.

In another words, therefore, depending upon the signal 10, representing a vocal message of the human 7, which is received and decodified by the means 8, the microprocessor 3 controls the generators 11 to cause them to generate stimuli aimed to stimulate the proper nervous fibres of the animal in the cerebral area of the animal inducing thereby the latter to take determined actions or perceive determined feelings.

The voltage applied by the stimuli generators 11 is very weak, i.e. it cannot be detected by a normal contact and has an average total power which is at least one hundred times lower than that of conventional cellular phones.

The vocal recognition means 8, which comprise an audio circuit board connected to a microphone, are able to convert, in a way known per se, a PCM (Pulse Code Modulation) digital audio signal coming from the board into a respective graphic of the amplitudes of the frequency components. With the vocal recognition means 8 there is also associated a second database (for instance codified in a suitable area of the memory means 5) containing several thousands of sample graphics, which identify different types of sounds which can be produced by the human voice. Actually, the sound entering into the system is identified by correlating it to the type of pre-recorded sound which is most close to that under examination.

Therefore, in practice, when the microphone perceives sound waves, the latter are processed by the vocal recognition means 8, which attend to selecting

and codifying the useful sounds. The corresponding codes are sent to the stimuli generators 11, which convert said codes into electric signals which stimulate the nervous fibres of the animal. These  
5 signals travel until they reach the auditive cortex of the animal brain, where they are recognised as being sounds.

Vocal recognition systems, well known per se, must be adapted to the voice of the user and to his way of  
10 speaking, in order to increase accuracy of operation. These features are just ensured by using a neural network architecture.

As it is known, neural networks are mathematical systems developed in the area of research on artificial  
15 intelligence, these systems being characterised by a high level of adaptability, meant as ability of learning and storing information, as well as of using the information when necessary and, above all, as ability to approximate an unknown function between  
20 input and output.

Also in the case of the present invention a "training" period is provided for the system, in order to reach a proper configuration of the neural network, which is necessary for the proper operation of the  
25 vocal recognition system.

This learning period is also necessary to correlate properly the signals 4 to corresponding stimuli-events-actions-feelings-behaviours of the animal, in order to emit a sound message by the  
30 loudspeaker 6, and to correlate properly the electric stimuli produced by the generators 11 to the corresponding vocal message emitted by the human 7.

With reference to the first aspect, the system is trained for recording the signals 4 generated by the  
35 animal "at work". An example of this activity may



consist in detecting the relation between a number of selected substances indicated by a human 7, which here acts as supervisor or trainer, and the corresponding signals 4 recorded by the microprocessor 3, which  
5 reflect the overall reactions of the animals in terms of effects-behaviours-feelings towards a determined smell-substance.

With reference to the second aspect, a number of basic words and phrases are recorded in the memory  
10 means 5 of the microprocessor 3, by means of the vocal recognition means 8. The vocalization of these words/phrases is associated to specific actions which the dog must take and their emission is controlled by the human 7, which also in this case acts as supervisor  
15 or trainer, through the neural network implemented in the control logic of the system. The algorithms of the neural network will produce the best relation between the vocal input provided by the human 7 and the output of the stimuli generators 11.

20 From the foregoing, it appears that the unit 1 provides actually an interface system between human and animal able to support a bi-directional communication, where:

- the input from-animal-to-human communication is  
25 constituted by data detected by means of sensors 2 and the output is the indication of the "status" in which the animal is at the moment, explicated by means of the loudspeaker 6,

- the input from-human-to-animal communication is  
30 constituted by vocal instructions coming from the human 7, detected by the vocal recognition means 8, while the output is provided by the stimuli generated by generators 11,

- the whole system being controlled by the neural  
35 network logic implemented in the microprocessor 3.

Due to the indicated features, the unit 1 according to the invention is able to simulate an exchange of human vocal messages between the user and the animal, in which the vocal messages "caused" by the animal are actually pre-recorded messages which are however selected by the microprocessor 3 so that they actually correspond to feelings-behaviours-thoughts-wishes of the animal.

According to an important feature of the invention, the provision of the neural network control system and the vocal recognition system 8 enables the microprocessor 3 to activate a self-learning logic in which the human 7 can correct or confirm by his vocal messages the vocal messages which the loudspeaker 6 emits on the basis of signals 4.

On the other hand, the animal is brought to develop its own language with time, with an evolutive process, through the interactive loop: brain-sensors 2-loudspeaker 6-microphone-emitters 11-brain, i.e. by hearing, with the aid of means 8 and loudspeaker 6, the vocalizations which the animal itself generates in association to its reactions to the environment.

All the above-indicated components, as well as the means necessary for the electric supply, can be made with modern technologies, in miniaturized dimensions and can be therefore positioned easily on the body of the animal, preferably on a single collar.

Naturally, while the principle of the invention remains the same, the details of construction and the embodiments may widely vary with respect to what has been described and illustrated purely by way of example, without departing from the scope of the present invention.

For instance, in a possible embodiment of the invention, the signal which reaches the vocal

recognition means 8, coming from the human, and the  
signal detected by the sensors 2, coming from the  
animal, interact in the neural network, in order to  
generate an answer or a stimulus which varies depending  
5 upon the interaction between the instructions from the  
human and the mental status of the animal.

CLAIMS

1. A vocal connection system between humans and animals, particularly domestic animals, characterised in that it comprises:

5       - a matrix of sensors (2) which is to be positioned on the animal, in particular on its head and/or its neck, for converting stimuli detected on the body of the animal into electric signals (4) which are indicative of a status of the animal, in terms of stimuli, feelings, events, actions or behaviours,

10       - processing means (3) operatively associated to the matrix of sensors (2), including memory means (5) in which human vocal messages are recorded corresponding to various status of the animal,

15       - a loudspeaker (6) operatively connected to the processing means (3),

      said processing means (3) being provided for receiving the signals (4) coming from the sensors (2) and for activating said loudspeaker (6) in order to emit a vocal message selected in said memory means (5), depending upon the said signals (4) which are received.

2. System according to claim 1, characterised in that it further comprises:

25       - vocal recognition means (8) able to send signals (10) to the processing means (3) which are representative of the contents of vocal messages (9) emitted by the human user (7), and

30       - stimuli generating means (11) operatively associated to the body of the animal, in particular to its head and/or neck, which receive said signals (10) which are representative of the contents of vocal messages (9) emitted by the user (7) from the processing means (3) and send corresponding stimuli to the animal brain.

3. System according to claim 2, characterised in that said processing means (3) are programmed to provide an interactive self-learning method where the human and animal are at the same level, where in particular the user (7) can correct or confirm the vocal messages emitted by said loudspeaker (6), by his vocal messages (9).

4. System according to claim 1 or 2, characterised in that the matrix of sensors (2), the processing means (3), the loudspeaker (6), the vocal recognition means (8) and the stimuli generating means (11) are integrated in a collar (C).

5. System according to claim 2, characterised in that the vocal recognition means (8) are used as supplementary means in addition to said sensors (2) in order to improve the interpretation of the status of the animal as detected by said sensors (2).

6. System according to claim 2, characterised in that it is adapted to develop with the time a language proper of the animal, by means of an evolutive process, through the hearing by the animal of the vocalization which the animal generates in association with its reactions to the environment.

7. System according to claim 1, characterised in that sensors (2) are provided to detect stimuli of different origin coming from the animal.

8. System according to claim 7, characterised in that first electrodes are provided which are operative to detect the electric activity of the animal brain and second electrodes to detect the electric activity of muscles and/or nerves of the animal.

9. System according to claim 1, characterised in that at least first and second sensors (2) are positioned just below respective ears of the animal or in any case close to the occipital cortex of the

animal, and further sensors (2) are arranged around the neck of the animal.

10. System according to claim 1, characterised in that a neural network control system is implemented in  
5 said processing means (3).

FIG. 1

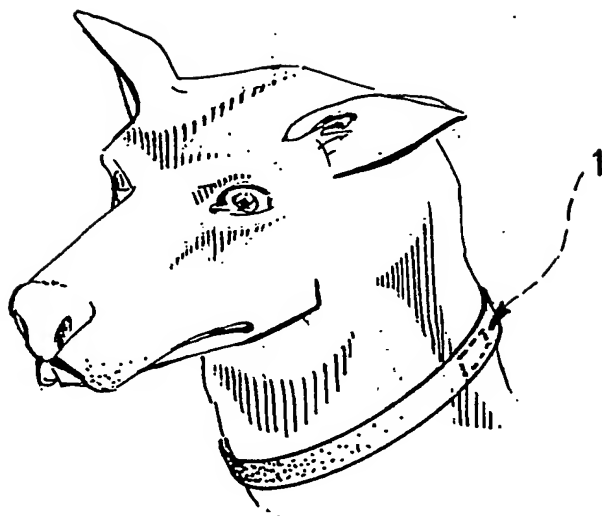
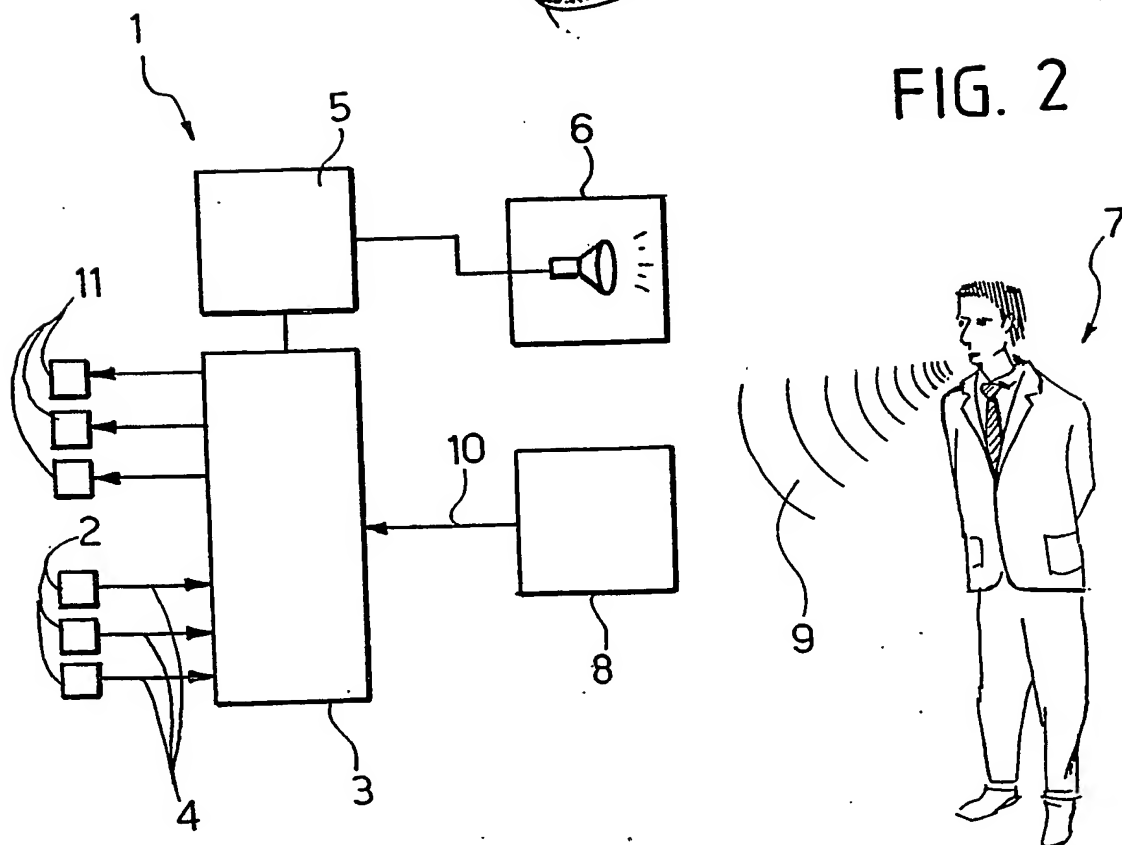


FIG. 2



## INTERNATIONAL SEARCH REPORT

PCT/IT 02/00183

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 A01K29/00 A01K15/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 A01K G06F G10L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

WPI Data, PAJ, EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 818 354 A (GENTRY TIMOTHY G) 6 October 1998 (1998-10-06) abstract ---	1,2,4,7, 8
Y	GB 2 350 263 A (LEIGHTON BERNARD) 22 November 2000 (2000-11-22) abstract; claims 1,4,5; figure page 2, line 3 - line 20 ---	1,2,4,7, 8
Y	EP 0 730 261 A (SEIKO EPSON CORP) 4 September 1996 (1996-09-04) abstract; figures 1,4,6 page 9, column 15, line 47 -page 10, column 17, line 5 page 11, column 19, line 21 - line 35 --- -/--	1,2,4,7, 8

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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